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15 December 1981

Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

(FOUO 18/81)

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CONTENTS

IVORY COAST

BRIEFS

TELEVISION PROGRAMS--Ivorian television began in 1963 and presently reception extends to 90 percent of the land, total reception is planned for next year. There are reportedly 250,000 TV sets in service and according to a survey the most popular programs are the newscast (51 percent), movies and serials (39 percent), sports (25 percent) and a program called "Comment ca va?" (18 percent) which gives humorous solutions to everyday problems. [Excerpt] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French No 1880, 20 Nov 81 p 2947] [COPYRIGHT: Rene Moreux et Cie Paris 1981]

CSO: 5500/5633

ITALY

PRESENT, FUTURE RESEARCH IN TELEMATICS DESCRIBED

Turin ELETTRONICA E TELECOMUNICAZIONI in Italian Jul-Aug 81 pp 142-148*

[Article by Dr Engr Basilio Catania, general manager of CSELT [Telecommunications Research and Study Center], Turin: "Status of Research on Telematics Technologies"; "Summary" is as published in English]

[Text] Summary--Research activity on telematics in Italy. In this article it is illustrated the state of the art of research carried out in Italy in the field of telematics, with particular emphasis on CSELT studies. Expected evolutions are taken into account with reference to different time situations, typical of the successive developments of the telecommunication network. It follows a description of the research in progress related to systems and protocols for services such as videotex, fac-simile, teletex, electronic mail, frozen-picture, recorded messages and other kinds of audioservices. In particular, the use of the so-called INFOWIRE technique allows to supply many of these services contemporaneously with the usual telephone service. Finally, mention is made of both the research concerning the future variable bandwidth network (ISDN of second generation) and the possible solution offered by a hybrid structure (satellite/optical fibres), which could anticipate and / or accelerate the supply of the above mentioned services with respect to a situation based on a fully-terrestrial network.

Research in telematics is being carried out in Italy under programs defined by the Ministry of Post and Telecommunications together with the SIP [Italian Telephone Company], with technical and scientific support being provided by the ISPT [Post and Telecommunications Research Center], the CSELT and the Bordoni Foundation. This article will refer essentially to the research being done at the

* [Editor's notes]: From the "Telematics '81" presentation held at the Milan Exhibition 15 April 1981.

Typescript received 2 June 1981.

CSELT, commissioned for the most part by the SIP, ITALTEL and recently by the SEAT. This research is directed toward satisfying the service requirements relative to three different situations, not phased as of now with respect to each other and dependent upon future development of the telecommunications network. These situations (diagramed in Fig 1) may be characterized as follows:

--Phase 1: Services capable of being provided by the existing telephone network when supplemented by the packet- and circuit-switching data network, actualization of which is to be completed in the near future;

--Phase 2: Services capable of being provided in fully digitalized form after digitalization at 80 kilobits/sec (64 + 16) of the existing distribution network, which is to follow the nationwide expansion of the necessary switching exchanges and digital transmission systems that will actualize the first generation of the so-called ISDN [Integrated Services Digital Network];

--Phase 3: Services capable of being provided in the future by a network able to adjust its performance characteristics to fit the bandwidth, extensive though it may be, required by the user; that is, by a second-generation ISDN.

The telematics services described in this article deal essentially with the first two of these phases, with emphasis on the desired objective of rendering viable the change from Phase 1 to Phase 2, specifically as contemplated by the system known as FILOINFORMAZIONE. The latter system, a practical demonstration of which was given during the presentation, makes it possible to provide telematics services with the present telephone and data network structure (Phase 1), supplemented by a few accessories but substantially unchanged as regards terminals, service exchanges and access procedures from the moment in which the network becomes fully digitalized and integrated into the services (Phase 2).

In particular, this article will discuss the research in progress on the equipment and procedures contemplated for Phases 1 and 2 mentioned above, in relation to the known services they can make available, namely, videotex (known in Italy as VIDEOTEL), facsimile, teletex, electronic mail, slow-scan video, recorded messages and various audio services, etc, defined as telematics services, although a very precise definition of these services has not been arrived at internationally as yet.

Lastly, mention will be made of some research relative to a variable-bandwidth network (second-generation ISDN) and to a possible solution by way of a hybrid satellite-optical fiber structure, which could antecede and/or accelerate an entirely terrestrial solution to Phase 3.

"Filoinformazione" (which has been named "Infowire" in English) is a method developed by the CSELT to provide interactive data services by means of two 16-kilobit/sec channels, in simultaneity with telephone service. In particular, videotex service can be provided in accordance with the British Prestel system without any changes except insofar as concerns the method of insertion at the exchange and at the subscriber terminal.

Figure 2 illustrates the operating principle with respect to the short-term situation (Phase 1). At the subscriber end, the telephone signal, which occupies the 0-4kHz portion of the band, is mixed with the data signal (as well as, in the overall case, the chargeable-time indicator at 12 kHz and the broadcast program signal carried above 163 kHz) by means of a signal insertion set. The data signal modulates digitally (using FSK [frequency-shift keying] modulation) the two carriers, positioned respectively at 27.5 and 52.5 kHz. In this manner, the various signals do not disturb each other and the subscriber can simultaneously use his telephone, his broadcast service and teletex service, as well as videotex or other telematics service requiring a bidirectional 16-kilobit/sec channel.

At the exchange, a similar device extracts the telematics signals, which are then channeled into the local services exchange or, via a leased-facilities network, to the distant services exchange, while the telephone signals are channeled into the normal switched network.

The simultaneity of telephone and data services made possible by the Filowire system must not be underestimated, above all because of the availability requirements in cases of emergency that have always contradistinguished telephone service throughout the world. Far from secondary also is the advantage of the simultaneous availability of both types of service under normal conditions as well to the various members of the family of a normal subscriber.

Figure 3 shows a typical videotex subscriber terminal consisting of a color television set (prewired for this service) that provides, for example, weather information at the same time that the telephone is being used for a conversation. At the lower right of the photograph is shown a prototype card for the insertion/modem set that is installed at the subscriber end.

During the Telematics '81 presentation a practical demonstration was given of the use of filowire service, obtained from a services exchange installed in the CSELT in Turin and consisting of a PDP11/60 computer containing the data bank with several videotex files prepared purely for demonstration purposes. The services exchange was connected to the exhibition hall by a dedicated SIP 4800-bits/sec line terminating in a suitable interface circuit which, under normal conditions would have been installed in an exchange.

The desired file is selected by using the television set's normal remote control keyboard.

By way of example, we will go through the steps necessary to obtain the desired information display.

Initially, the television set displays the words:

THE SYSTEM IS READY

SELECT A FILE

Pressing key ≠ (request for main file index) displays the index; then selecting, for example, and pressing key 3 displays the file:

WEATHER AND ROAD CONDITIONS

Of course, should it be desired at this moment to initiate a telephone call simultaneously it can be done, and, during that call, exact-time service, for example, can also be obtained by dialing the 161 code on another telephone instrument connected to the same "bight" as the television set, and, as was demonstrated at the presentation, the two services can be provided without interfering with each other.

Coming back to infowire, key 2 may be selected:

MAX AND MIN TEMPERATURES

thus displaying a geographic map of Italy showing maximum temperatures, after which key Ø (continuation) may be pressed to display a map like the previous one but showing minimum temperatures.

Pressing key ≠ again will bring back the main index and other files may be selected, and so on.

Canada, the United States and France are currently experimenting with network solutions similar to infowire, while other European nations (Germany, Holland and Japan [as published]) are experimenting with solutions of the British type, that is, with switching that will provide telephone or videotex services but only on an alternate basis.

It is emphasized that the infowire system is structured for assured compatibility with the future network to be integrated into the services (Phase 2). In fact, the solution based on the present network (Fig 4), as has been said, makes it possible to transmit the 4-kHz telephone-band signals as well as the telematics services (videotex, facsimile, teletex or other data services) via the normal telephone "bight" to a conventional telephone exchange, equipped, however, with a suitable interface device, toward services exchanges and the data network.

As soon as the distribution network is digitalized (Fig 5), the telephone signal will be coded at 64 kilobits/sec and multiplexed with the telematics services by means of a component called a CTE (Circuit Terminating Equipment or subscriber terminating set) enabling a bidirectional 64 + 16 = 80-kilobits/sec digital stream.

At the exchange, the stream will be subdivided into its two components, which will be channeled respectively into the digital telephone network and, through a suitable set of equipment (called an ET [Data Processing Computer]), into services centers or the data leased-facilities network. Thus, no change will be required as regards terminals on subscriber premises (an important consideration, since new services can be phased in beginning now without impediment from this standpoint), the data networks and the services centers, and--again a not negligible consideration--as regards the subscriber distribution network, which will however be interfaced on both sides by new modems, to which we will refer later.

Figure 6 shows a prototype of a CTE designed and built by the CSELT, photographed near a videodata terminal with keyboard. As regards the modems, three different types are currently being evaluated, as is being done moreover in other international laboratories:

--A time-division (ping pong) type (Fig 7), presently being tested on live traffic facilities in the SIP network, with satisfactory results;

--A frequency-division type (Fig 8), currently being tested under laboratory conditions, also with satisfactory results;

--An echo-suppressor type, operation of which has been fully computer-simulated, enabling the executory process to begin.

As we have thus seen, research aimed at making available telematics services under solutions relative to the above-cited Phases 1 and 2 is at a well-advanced stage. It nust be pointed out, however, that both solutions are dependent upon actualization of the packet- and circuit-switching data network, which, however, as was stated at the beginning of this article, should be completed within a few years, according to the Ministry of Post and Telecommunications and the SIP (Fig 9).

The CSELT has contributed to this actualization with--besides detailed system studies and support provided to the Ministry of Post and Telecommunications and SIP in the drawing up of specifications--the design and building of the so-called ACP [Packet Adapter-Concentrator], which provides the interface between the packet-switching data network and the so-called "access network," that is, from the normal telephone, telex and leased-facilities networks by "packet" subscribers. The importance of this equipment is evident if one considers the number of such sets of equipment that will have to be used in the network: Each of these sets can handle a maximum 64 active terminals simultaneously.

The ACP has many functions. Besides collecting the traffic from the access network, it adapts the language of the subscriber terminals to that of packet transmission and switching, or, "X25 Procedure," and concentrates the traffic at high-capacity junctures, enabling facility-utilization factors 10 to 100 times greater than those obtainable with circuit-switching systems. Moreover, the ACP being a smart component equipped with memory, it can function as a "flow control," that is, carry out all the functions necessary to avoid overloads (hence potential losses of data) both in the network and at subscriber terminals.

The "X28 Procedure" has been developed to enable connecting up to the ACP 85 percent of the asynchronous character terminals presently on the Italian market and the synchronous ones (that is, with X25 Procedure) that are becoming increasingly widely available.

Figure 10 shows the prototype designed and built by the CSELT in collaboration with ITALTEL, and already delivered to ITALTEL, on the basis of which it will be further engineered after the requisite positive results have been obtained in the field tests it is currently undergoing between Turin (CSELT) and Castelletto (ITALTEL).

In addition to the types of equipment described thus far, which are essentially system components related to successive Phases 1 and 2, the CSELT is actively engaged in research on terminals and on exchange equipment specifically intended to enabling the offering of certain telematics services.

One of these services is the so-called slow-scan video service (Fig 11), which can transmit fixed or slowly-updatable images, useful for supervisory monitoring (e.g., traffic, intrusion, telemedicine, banking applications, etc), as well as for visual aid to audio or videoconference proceedings (transmission of slides). The equipment currently being tested by the CSELT permits the transmission of frozen-images over an analog telephone line at speeds of 4.2 or 9.6 kilobits/sec and over digital lines at 64 kilobits/sec. Update times can be varied from 32 seconds with no reduction of redundancy, hence with very high quality, down to 1/2 second with heavy reduction of redundancy, requiring toleration however of a consequent reduction in quality of the received image.

Lastly, with reference to message recording service, this is presently in study stage with respect solely to telephony. In this regard, it should be noted that many telematics services could be provided simply via audio facilities to those subscribers who might wish to have only a telephone terminal, and no other kind, connected into the network; this will be possible as soon as the techniques of voice synthesis and recognition, in which the CSELT has already obtained interesting results, are sufficiently perfected and become economically viable.

Message recording service (Fig 12) provides--besides delayed transmission of messages--telephonic secretarial service, the recording of calls and intercept service.

The subscriber accesses the system either by dialing a special number for delayed message service, or automatically for all the other services.

The system furnishes instructions to the subscriber by way of telephoned procedural announcements, and receives information by way of the keyboard or the disk (or, if the system does not accommodate use of the disk, by way of numbers pronounced by the subscriber and recognized by the word-recognizing equipment).

Analog or digital telephony undergoes a 4 to 1 compression (16 kilobits/sec) and is recorded in digital form in magnetic disk equipment.

The system control coordinates the blocks and handles the index-filing of the recording.

Retrieval of the recorded message may be accomplished by subscriber interrogation of the system ("Have you any messages for me ") or by automatic followup by the system ("I have a message to repeat to you.").

The mass-memory requirement for a large urban network, and based on duplicating every message (that is, recording it on two separate disks for greater security), is estimated at around 5,000 megabytes, if recording is done at 16 kilobits/sec.

Experimental development of this system has already started for the account of SIP, and all concerned, except the government, have been made ready for it. The system is to be field tested together with many of the devices planned for the actualization of Phase 2 (CTE, digital modems and infowire) in conjunction with the digital exchange (UT10/3) that is now in the pilot production stage by ITALTEL. Following this test, other tests will be carried out in conjunction with traditional electromechanical exchanges.

What has been said until now relates to the status of networks corresponding to Phases 1 and 2, and from what has been said it is clear that studies are presently at a very advanced stage, solutions sufficiently defined, and moreover that the transition from Phase 1 to Phase 2 is planned in such a way as to produce the least possible waste of resources.

The same cannot be said of the transition from Phase 2 to Phase 3; that is, from operation substantially at 80 kilobits/sec to operation based on variable-within-very-wide bandwidth service requirements (up to bandwidths of several tens of megabits/sec). The fact is that in this case copper-wire distribution network can no longer be used and resort will have to be made to optical fibers; furthermore, optical fibers will probably have to be used in the premises of business subscribers as well, with time-division ring structures, for example, and with CTE equipment of newer design and in general smarter; there will be no reason, however, to replace existing terminal equipment, but merely to increase its numbers and types in accordance with the further new service requirements.

As regards switching exchanges, it is clear that even the modern digital exchanges being planned by the first-generation ISDN will be unsuited to the handling of the wideband and at the same time variable bandwidth traffic, and that switching centrals of a new conception will have to be resorted to.

Lastly, the medium- and long-distance networks will also find themselves in trouble, having as they will to handle substantially increased traffic loads with variable bandwidth characteristics and a rate of evolution with time that will depend heavily upon the growth in demand for such types of services, consisting initially with that on the part of "business subscribers."

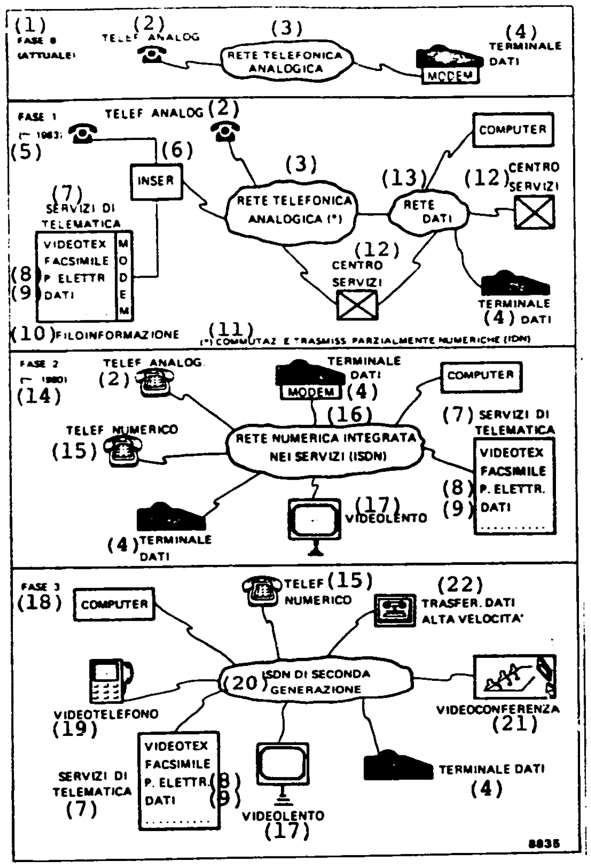
It is highly probable therefore that regenerative satellites with on-board switching will play a determinative role, as much from the standpoint of more favorable access techniques as from that of flexibility of interconnection with subscribers as a whole (irregularly dispersed, from a topographical standpoint), and from that of faster development and placement in service.

Several long-term traffic forecasts compiled recently estimate traffic in Phase 3 at a little less than one order of magnitude greater than in Phase 2 (even though the future involved is rather distant). Based on this, it appears inevitable that the network required for Phase 3 must grow out of and be piggy-backed on that of Phase 2, perhaps using only its available civil works infrastructure (buildings, underground ducts, etc).

Investment requirements relative to Phase 3 are estimated to be very high and the managers of telecommunications networks will therefore be confronted by far from easy planning problems in trying to satisfy these future demands, which are being placed at somewhere beyond the 1990's.

Advanced studies are in progress at the CSELT with respect to all the components of this future wideband network, and specific studies are in progress on methods of ring interconnections at different topological hierarchies; on distributed, variable-within-wideband bandwith exchanges; on interconnection of second-generation terminals with videoconference and videoservice systems in general; and on integration between terrestrial and satellite networks. In this sector, the CSELT is currently participating, from the national standpoint, in the Campus NET [expansion unknown] program sponsored by the CNR [National Research Council], and, from the European standpoint, in the EEC's COST [expansion unknown] 202 program.

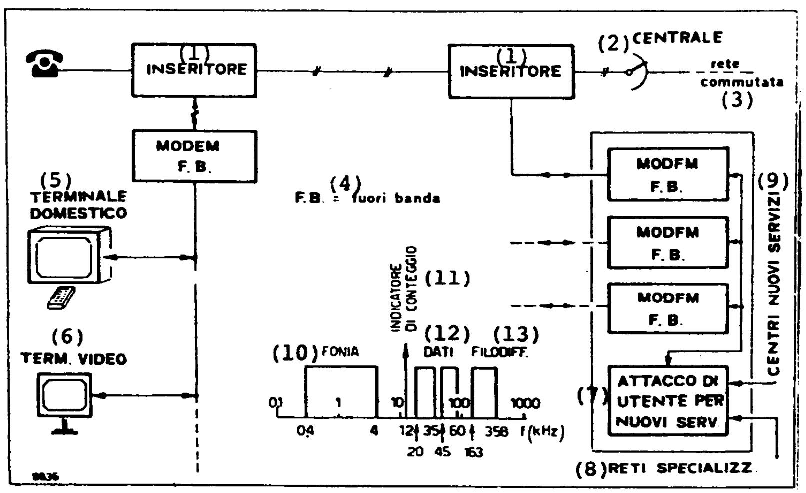
An idea can be had from what has been presented in this article of the research effort presently being deployed in the field of telematics. It appears from this, moreover, that this national effort is very much in line, as regards quantity as well as quality, with that of other international laboratories of high standing.



Key:

1. Phase 0 (present).
2. Analog telephone set.
3. Analog telephone network.
4. Data terminal.
5. Phase 1 (approximately 1983).
6. Insertion set.
7. Telematics services.
8. Electronic mail.
9. Data.
10. Infowire.
11. Part-digital switching and transmission.
12. Services center.
13. Data network.
14. Phase 2 (around 1990.
15. Digital telephone set.
16. ISDN (Integrated Services Digital Network).
17. Slow-scan video.
18. Phase 3.
19. Videotelephone.
20. Second-generation ISDN.
21. Videoconference.
22. High-speed data transfer.

Fig 1 - Evolution of the telecommunications IDN [Integrated Digital Network].



Key:

1. Insertion set.
2. Exchange.
3. Switched network.
4. F.B. = Out-of-band.
5. Domestic terminal.
6. Video terminal.
7. Subscriber terminal for new services.
8. Leased-facilities network.
9. New-services centers.
10. Telephony.
11. Chargeable-time indicator.
12. Data.
13. Broadcast program service.

Fig 2 - Operating principle of the infowire system based on the projected short-term network configuration (Phase 1).

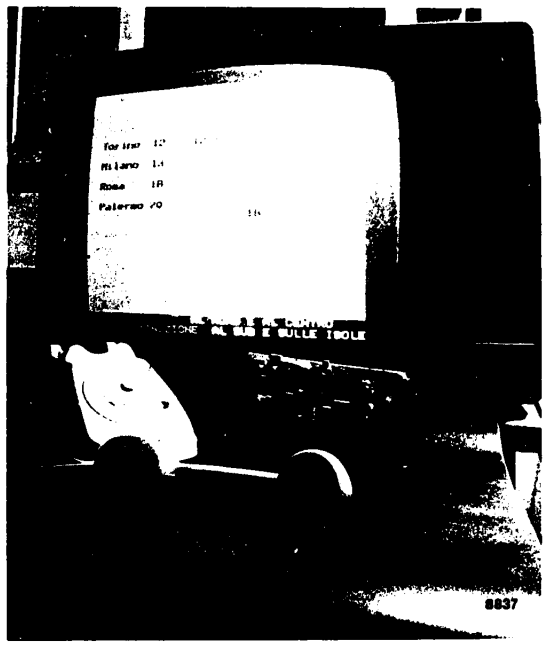
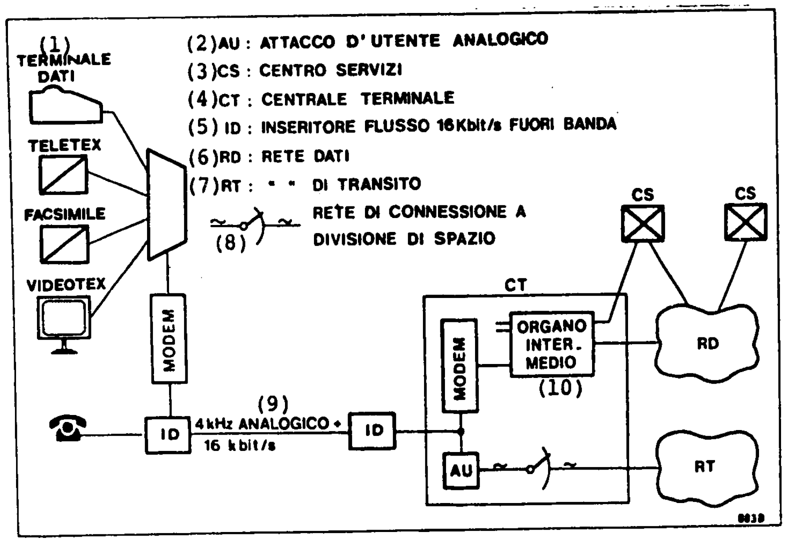


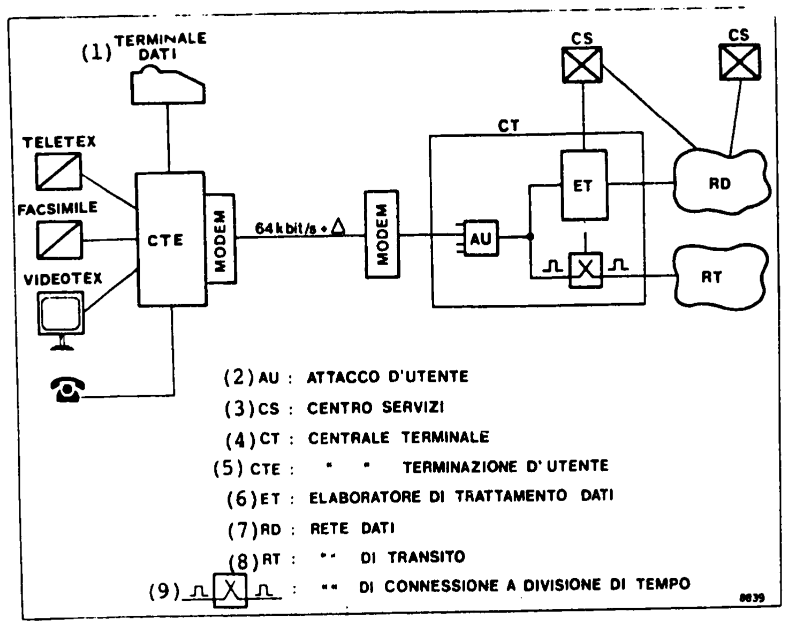
Fig 3 - View of subscriber terminal for
videotex service using infowire.



Key:

1. Data terminal.
2. AU = Subscriber analog termination.
3. CS = Services center.
4. CT = Terminal exchange.
5. ID = Out-of-band 16-kilobits/sec bit stream insertion set.
6. RD = Data network.
7. RT = Transit network.
8. Space-division connecting network.
9. 4-kHz analog - plus - 16 kilobits/sec.
10. Interface component.

Fig 4 - Compatibility of infowire system with the future first-generation ISDN (Phase 2).



Key:

1. Data terminal.
2. AU = Subscriber termination.
3. CS = Services center.
4. CT = Terminal exchange.
5. CTE = Subscriber terminations exchange.
6. ET = Data processing computer.
7. RD = Data network.
8. RT = Transit network.
9. Time-division connecting network.

Fig 5 - Schematic of access network into first-generation ISDN ambit (Phase 2).

Fig 6 - Prototype of CTE [Circuit Terminating Equipment].

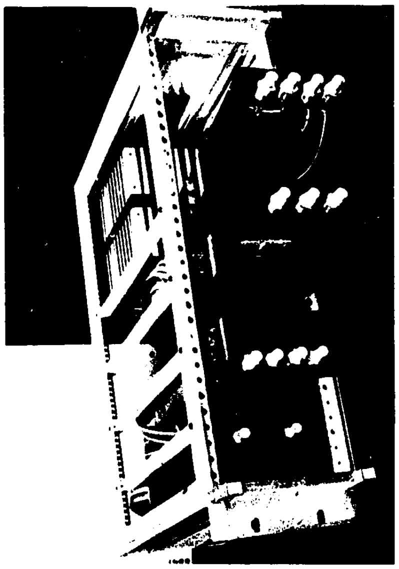


Fig 7 - Prototype of time-division (ping pony) modem for digital transmission on subscriber "bight."

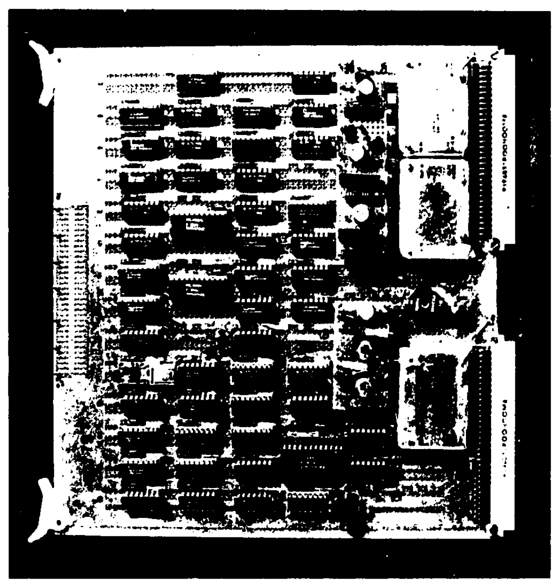


Fig 9 - Prototype of frequency-division modem for transmission on subscriber "bight."

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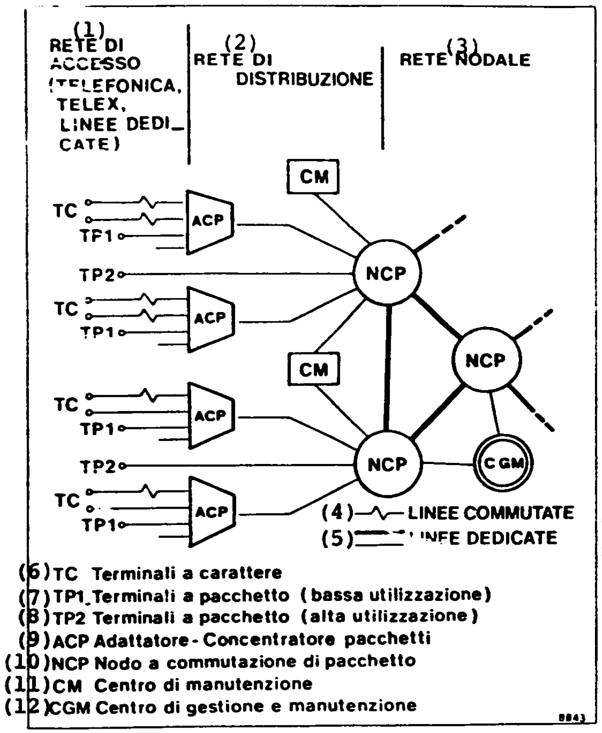


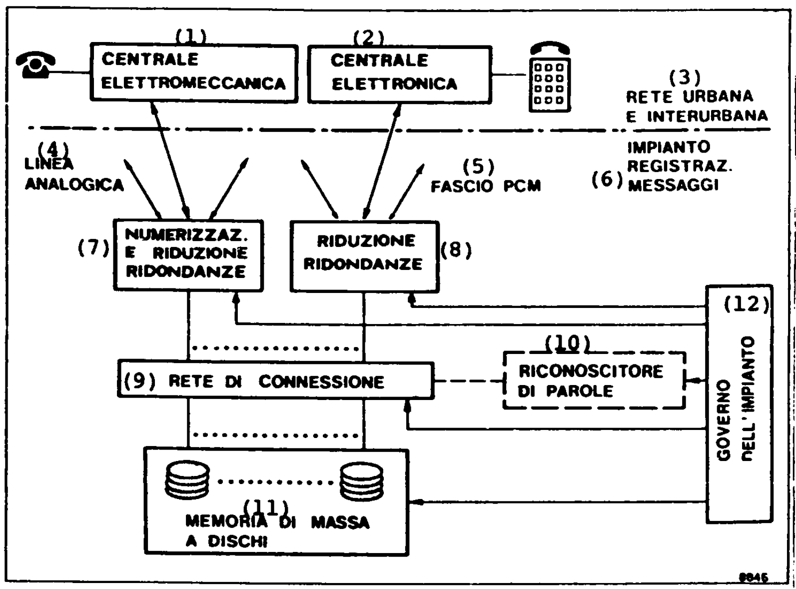
Key:

1. Access network (telephony, telex, dedicated lines).
2. Distribution network.
3. Hubbing network.
4. Switched lines.
5. Dedicated lines.
6. TC = Character terminals.
7. TP1 = Low-capacity packet terminals.
8. TP2 = High-capacity packet terminals.
9. ACP = Packet adapter-concentrator.
10. NCP = Packet-switching hub.
11. CM = Maintenance center.
12. CGM = Management and maintenance center.

Fig 9 - Configuration of nationwide packet-switched data network.

Fig 10 - Overall view of ACP [Packet Adapter-Concentrator].

Fig 11 - Frozen-image (slow-scan video) transmission system.



Key:

1. Electromechanical exchange.
2. Electronic exchange.
3. Urban and interurban networks.
4. Analog line.
5. PCM [pulse-code-modulated] beam.
6. Message recording system.
7. Digitalization and redundancy reduction.
8. Redundancy reduction.
9. Interconnection network.
10. Word recognizer.
11. Disk-type mass memory.
12. System control.

Fig 12 - Schematic of telephone message recording system operation.

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